## CLAIMS

1. (Currently Amended) A network controller-implemented method of partitioning capacity of a network into working capacity and restoration capacity, the method comprising the steps of:

(a) the network controller generating a set of network constraints for a network of nodes interconnected by links in accordance with a network topology, wherein the network constraints include:

1) for each link, a set of one or more detour paths exist whose capacities sum to the working capacity of the link;

2) for each link, the sum of the working capacity and the restoration capacity, as a whole, shared by the set of one or more detour paths is, at most, a total capacity of the link; and

3) the working capacity of the network is maximized;

(b) the network controller formulating a linear programming problem (LPP) for the network topology based on the set of network constraints; and

(c) the network controller generating either an exact or an approximate solution for the LPP, the solution including a working capacity and a restoration capacity of each link of the network.

2. (Original) The invention of claim 1, further comprising the step of (d) partitioning the capacity of each link of the network based on the solution for the LPP.

3. (Cancelled)

4. (Previously Presented) The invention of claim 1, wherein, for step (b), the LPP formulation is generated for the network having an equal partition size for the working capacity and restoration capacity of each link $e$ of a set $E$ of links in the network, and step (c) generates the solution based on a fraction $\alpha$ for the equal partition size, the fraction $\alpha$ given by:

$$\alpha = \min_{e \in E} \frac{F(e)}{u_e + F(e)}$$

where "min(•)" denotes the mathematical "minimum of •", $u_e$ is the capacity of link $e$, and $F(e)$ is the maximum flow value between nodes coupled by $e$ when $e$ is removed from the network.

5. (Original) The invention of claim 1, wherein, for step (b), the LPP is a path-indexed LPP formulation.

6. (Original) The invention of claim 5, wherein step (c) further comprises the step of (c1) generating a dual of the path-indexed LPP formulation.

7. (Original) The invention of claim 6, wherein step (c) further comprises the step of (c2) approximating the solution with a (1+ε) approximation algorithm.

8. (Currently Amended) The invention of claim 5, wherein, for step (c), the path-indexed LPP formulation is given by:

$$\max \sum_{e:e\in E} \sum_{P:P\in \mathrm{P}_e} f(P), \text{ subject to}$$

$$\sum_{P:P\in \mathrm{P}_e} f(P) + \sum_{P:P\in \mathrm{P}_f, e\in P} f(P) \leq u_e \qquad \forall f \neq e, \quad e, f \in E,$$

where "max(•)" denotes the mathematical "maximize •", $E$ denotes a set of links in the network, $e$ and $f$ are links in the network, $u_e$ denotes the capacity of link $e$, $\mathrm{P}_e$ denotes the set of all paths $P$ that do not contain link $e$, and $f(P)$ denotes the restoration traffic on a given path $P$ after failure of the link that it protects.

9. (Original) The invention of claim 1, wherein, for step (b), the LPP is a link-indexed LPP formulation.

10. (Currently Amended) The invention of claim 9, wherein, for step (b), the link-indexed LPP formulation is given by:

$$\max \sum_{(k,l)\in E} x_{kl}$$

$$\sum_{j:(i,j)\in E} y_{ij}^{kl} - \sum_{j:(j,i)\in E} y_{ji}^{kl} = \begin{cases} x_{kl} & \text{if } i = k \\ -x_{kl} & \text{if } i = l \\ 0 & \text{otherwise} \end{cases}$$

$$\forall\ i\in N,\ (k,l)\in E;\ y_{kl}^{kl} = 0\ \ \forall\ (k,l)\in E$$

$$x_{kl} + y_{kl}^{ij} \leq u_{kl}\ \ \forall (i,j),(k,l)\in E,\ (i,j)\neq (k,l),$$

where $i$, $j$, $k$, and $l$ are indices corresponding to node numbers, "max(•)" denotes the mathematical "maximize •", $N$ denotes a set of nodes in the network, $E$ denotes a set of links in the network, $u_{ij}$ denotes the capacity of link $(i,j)$, $x_{ij}$ $(0 \leq x_{ij} \leq u_{ij})$ denotes a working capacity reserved on link $(i, j)$, $y_{ij}^{kl}$ denotes a network flow equal to $x_{ij}$ from node $k$ to node $l$ using links other than $(k, l)$.

11. (Original) The invention of claim 1, wherein, for step (a), the network is either an electro-optical network or a packet-based network.

12. (Currently Amended) A network controller-implemented method of partitioning capacity of links in a network into working capacity and restoration capacity, the method comprising the steps of:

(a) the network controller determining a link $\overline{e}$ and a corresponding shortest path $P$ that minimize a combination of i) a sum of a set of shortest-path link weights of the corresponding path $P$ when $\overline{e}$ fails and ii) a sum of the link weights when each other link not in the corresponding path $P$ fails;

(b) the network controller computing a minimum capacity of i) the capacity of link $\overline{e}$ and ii) the smallest link capacity of each of the links on the corresponding path $P$;

(c) the network controller updating each of the link weights based on the minimum capacity in accordance with a (1+ε) approximation method;

(d) the network controller incrementing, by the minimum capacity, the working capacity on link $\overline{e}$ and the restoration capacity of each link in the given path $P$; and

(e) the network controller repeating steps (a) through (e) until a set of dual network constraints are satisfied.

13. (Previously Presented) The invention of claim 12, further comprising the step of scaling, if the set of dual network constraints are satisfied, the working capacity and the restoration capacity of each link so as to satisfy a set of primal capacity constraints.

14. (Original) The invention of claim 12, wherein the method is implemented by a processor of a centralized network management system.

15-16. (Cancelled)

17. (Currently Amended) A network controller-implemented method of partitioning capacity of a network into working capacity and restoration capacity, the method comprising the steps of:

(a) the network controller generating a set of network constraints for a network of nodes interconnected by links in accordance with a network topology;

(b) the network controller formulating a linear programming problem (LPP) for the network topology based on the set of network constraints; and

(c) the network controller generating either an exact or an approximate solution for the LPP, the solution including a working capacity and a restoration capacity of each link of the network;

wherein, for step (b), the LPP formulation is generated for the network having an equal partition size for the working capacity and restoration capacity of each link $e$ of a set $E$ of links in the network, and step (c) generates the solution based on a fraction α for the equal partition size, the fraction α given by:

$$\alpha = \min_{e \in E} \frac{F(e)}{u_e + F(e)},$$

where "min(•)" denotes the mathematical "minimum of •", $u_e$ is the capacity of link $e$, and $F(e)$ is the maximum flow value between nodes coupled by $e$ when $e$ is removed from the network.

18. (Currently Amended) A network controller-implemented method of partitioning capacity of a network into working capacity and restoration capacity, the method comprising the steps of:

(a) the network controller generating a set of network constraints for a network of nodes interconnected by links in accordance with a network topology;

(b) the network controller formulating a path-indexed linear programming problem (LPP) for the

network topology based on the set of network constraints; and

(c) the network controller generating either an exact or an approximate solution for the LPP, the solution including a working capacity and a restoration capacity of each link of the network, wherein the path-indexed LPP formulation is given by:

$$\max \sum_{e:e\in E} \sum_{P:P\in \mathrm{P}_e} f(P) \text{, subject to}$$

$$\sum_{P:P\in \mathrm{P}_e} f(P) + \sum_{P:P\in \mathrm{P}_f, e\in P} f(P) \le u_e \qquad \forall f \ne e, \quad e, f \in E,$$

where "max(•)" denotes the mathematical "maximize •", $E$ denotes a set of links in the network, $e$ and $f$ are links in the network, $u_e$ denotes the capacity of link $e$, $\mathrm{P}_e$ denotes the set of all paths $P$ that do not contain link $e$, and $f(P)$ denotes the restoration traffic on a given path $P$ after failure of the link that it protects.

19. (Currently Amended) A network controller-implemented method of partitioning capacity of a network into working capacity and restoration capacity, the method comprising the steps of:

(a) the network controller generating a set of network constraints for a network of nodes interconnected by links in accordance with a network topology;

(b) the network controller formulating a link-indexed linear programming problem (LPP) for the network topology based on the set of network constraints; and

(c) the network controller generating either an exact or an approximate solution for the LPP, the solution including a working capacity and a restoration capacity of each link of the network, wherein the link-indexed LPP formulation is given by:

$$\max \sum_{(k,l)\in E} x_{kl}$$

$$\sum_{j:(i,j)\in E} y_{ij}^{kl} - \sum_{j:(j,i)\in E} y_{ji}^{kl} = \begin{cases} x_{kl} & \mathit{if}\ i = k \\ -x_{kl} & \mathit{if}\ i = l \\ 0 & \mathit{otherwise} \end{cases}$$

$$\forall\ i \in N,\ (k,l) \in E;\ y_{kl}^{kl} = 0\ \ \forall\ (k,l) \in E$$

$$x_{kl} + y_{kl}^{ij} \le u_{kl}\ \ \forall (i,j),(k,l) \in E,\ (i,j) \ne (k,l),$$

where $i$, $j$, $k$, and $l$ are indices corresponding to node numbers, "max(•)" denotes the mathematical "maximize •", $N$ denotes a set of nodes in the network, $E$ denotes a set of links in the network, $u_{ij}$ denotes the capacity of link $(i,j)$, $x_{ij}$ $(0 \le x_{ij} \le u_{ij})$ denotes a working capacity reserved on link $(i, j)$, $y_{ij}^{kl}$ denotes a network flow equal to $x_{ij}$ from node $k$ to node $l$ using links other than $(k, l)$.